PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
KEVIN C BROWN
BURR AND BROWN
P.O. BOX 7068
SYRACUSE, NY 13261

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing (*day/month/year*)	20 JUL 2005
Applicant's or agent's file reference 857_043 WO	FOR FURTHER ACTION See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US05/02085	24 January 2005 (24.01.2005)	22 January 2004 (22.01.2004)

International Patent Classification (IPC) or both national classification and IPC

IPC(7): H01L 31/06, 31/0328 and US Cl.: 257/184,187,189, 461-465; 438/48,81,87,309

Applicant

HALL, ROBERT B

1. This opinion contains indications relating to the following items:

- [X] Box No. I — Basis of the opinion
- [ ] Box No. II — Priority
- [ ] Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV — Lack of unity of invention
- [X] Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI — Certain documents cited
- [ ] Box No. VII — Certain defects in the international application
- [ ] Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Donghee Kang Telephone No. 571-272-1656

Form PCT/ISA/237 (cover sheet) (January 2004)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/02085

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☒ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☒ in written format

☐ in computer readable form

c. time of filing/furnishing

☒ contained in international application as filed.

☐ filed together with the international application in computer readable form.

☒ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/02085

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 3-18, 20, 25, & 35-47	YES
	Claims 1-2, 19, 21-24, 26-34, 48 & 49	NO
Inventive step (IS)	Claims 3-18, 20, 25 & 35-47	YES
	Claims 1-2, 19, 21-24, 26-34, 48 & 49	NO
Industrial applicability (IA)	Claims 1-49	YES
	Claims NONE	NO

2. Citations and explanations:

Claims 1-2, 19, 21-24, 26-34, 48 & 49 lack novelty under PCT Article 33(2) as being anticipated by Razeghi (US 6,452,242).

Re claims 1, 24, 30 & 31, Razeghi teaches a phototransistor, comprising:

A substrate comprising antimony (Col.2, lines 29-30); an emitter comprising antimony; a base comprising antimony, said base comprising an emitter-contacting portion which is in contact with a base-contacting portion of said emitter; and a collector comprising antimony, said collector comprising a base-contacting portion which is in contact with a collector-contacting portion of said base, said phototransistor producing an internal gain being contacted with light within a receivable wavelength ranges (Col.5, lines 10-16).

Re claim 2, Razeghi teaches said emitter, said base, and said collector are each substantially lattice-matched.

Re claim 19, Razeghi teaches said emitter-contacting portion of said base comprises a first bandgap valus and said base-contacting portion of said emitter comprises a second bandgap value, said first bandgap value less than said second bandgap value.

Re claim 21, Razeghi teaches said collector-contacting portion of said base has a third bandgap value, said second bandgap value being substantially equal to said third bandgap value.

Re claim 22, Razeghi teaches said collector-contacting portion of said base has a third bandgap value, said second bandgap value being greater than said third bandgap value.

Re claim 23, Razeghi teaches phototransistor further comprising a substrate.

Re claims 27-28, Razeghi teaches said emitter, said base and said collector together comprises an n-p-n transistor or a p-n-p transistor.

Re claim 29, Razeghi teaches said receivable wavelength range is from 1.8 micrometers to 2.5 micrometers.

Re claims 32 & 34, Razeghi teaches said process comprises metal-organic vapor deposition processes.

Re claim 33, Razeghi teaches a method of forming a phototransistor that produces an internal gain upon being contacted with light within a receivable wavelength ranges, said method comprising:

Forming a collector comprising antimony on a substrate comprising antimony using a process such that said collector is substantially lattice matched to said substrate; forming a base comprising antimony and having a collector-contacting portion in contact with a base-contacting portion of said collector using a process such that said base is substantially lattice matched to said collector; and forming an emitter comprising antimony and having a base-contacting portion in contact with an emitter-contacting portion of said base using a process such that said emitter is substantially lattice matched to said base.

Re claim 48, Razeghi teaches a method of detecting light, comprising contacting a phototransistor as recited in claim 1 with light comprising at least a first wavelength, said first wavelength falling within said receivable wavelength range, and applying a current through said phototransistor, said current being amplified as a result of light contacting said phototransistor.

Re claim 49, Razeghi teaches said light comprises infrared light.

Claims 3-18, 20, 25, & 35-47 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest claimed materials, base bandgap gradient or base comprising a first and second base layer.

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